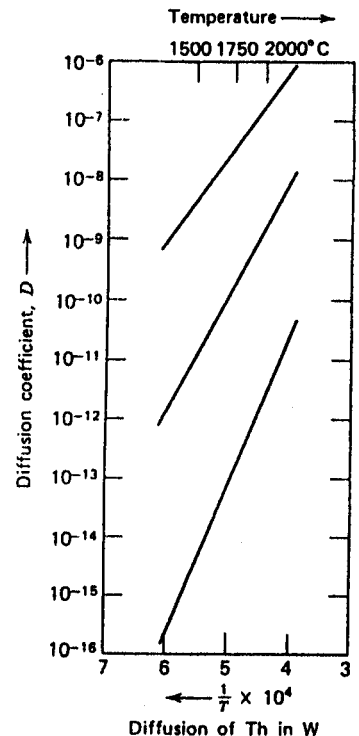


1.
 - (a) 拉伸實驗為測試材料強度之基本方法之一，請繪出其所測出之 Engineering Stress-Strain 曲線及 True Stress-Strain 曲線。並解釋其定義。(5%)
 - (b) 何謂 Considere's criterion for necking。並試用一簡易公式描述常見之 True Stress-Strain 曲線。(5%)
 - (c) Why some materials with BCC crystal has Sharp Yield Point? (5%)

2.
 - (a) Please show where the Octahedral Void and Tetrahedral Void located in the FCC and BCC unit cells repectively? (5%)
 - (b) How many of Octahedral Voids and Tetrahedral Voids in each FCC and BCC unit cells repectively? Please use Miller indices to express the locations of these octahedral and tetrahedral voids。(5%)
 - (c) The iron FCC crystal structure is able to dissolve a much larger concentration of carbon than is the BCC structure. Please explain why。(5%)

3.
 - (a) 右圖所示為 Th 在 W 中之三種擴散速率對溫度之關係圖：此三種擴散分別為 (i) Grain Boundary Diffusivity, (ii) Lattice Diffusivity, and (iii) Surface Diffusivity, 請問其所代表之物理意義為何？應以何順序排列？(5%)
 - (b) 此類速率對溫度之關係圖，可以用何種數學方程式表示？通常稱為何種反應？其反應動力學上之意義為何？(5%)
 - (c) 請推導一關係式，表示總觀(apprent)之擴散速率與 Grain Boundary Diffusivity 和 Lattice Diffusivity 之關係？並利用此關係式解釋在何種狀況下，溶質元素在多晶材料中之擴散速率較單晶材料中為快？(5%)



4.
 - (a) 一般而言，冷加工(Cold Work)後之退火(Annealing)熱處理時會發生三階段之變化，請分別簡述其現象及原因。(7%)
 - (b) 一般之潛變(Creep)實驗在固定溫度與應力下進行，其應變(strain)對時間之關係會發生三階段之變化，請分別簡述其現象及原因。(8%)

(背面仍有題目,請繼續作答)

5.

- (a) X-ray 常用於材料之檢測，請敘述最常用之二種方法。並請描繪現代化之 X-ray diffractometer 之構造簡圖，並敘述其功能。？(5%)
- (b) 何謂 Continuous X-ray 及 Characteristic X-ray ？(5%)

6.

- (a) What is the strain energy of a screw and an edge dislocation? Which is larger? (3%)
- (b) What is the dislocation density of a well-annealed and cold worked metallic crystal? (3%)
- (c) Is it possible to have a dislocation-free materials? Please explain why? (3%)
- (d) What is the Hall-Petch equation? (3%)
- (e) What is the dislocation atmospheres? (3%)

7.

- (a) Please explain what is the fatigue fracture of metallic material. (5%)
- (b) The figure on the right is a typical fatigue fracture surface which shows two regions with characteristically different aspects. Please identify these two regions and the origin of fracture (自圖中之 A-E 點中選出). Explain why. (5%)
- (c) Fatigue properties can usually be expressed by the S-N curve. Please draw a typical S-N curve for a steel and an aluminum alloy sample respectively. Please discuss and explain the difference of these two S-N curves. (5%)

